WHAT IS CLAIMED IS:

1. A magnetic head comprising:

a lower core layer extending from the front surface of the magnetic head in the height direction of the magnetic head, the front surface facing a recording medium;

a protruding layer formed on the lower core layer, extending from the front surface of the magnetic head in the height direction by a predetermined length;

a back gap layer formed on the lower core layer away from the rear end surface of the protruding layer in the height direction by a predetermined distance;

a coil layer that is at least partially included in a space surrounded by the lower core layer, the protruding layer, and the back gap layer;

a coil-insulating layer covering the coil layer;

a gap-depth defining layer composed of a nonmagnetic material and disposed on the top surface of the protruding layer away from the front surface of the magnetic head in the height direction by a predetermined distance;

a first seed layer composed of a metal, covering the entire top surface of the gap-depth defining layer;

a lower magnetic pole layer formed on the protruding layer on the front side of the gap-depth defining layer, the rear end surface of the lower magnetic pole layer being in contact with the front end surface of the gap-depth defining layer;

a gap layer formed on the lower magnetic pole layer, the

rear end surface of the gap layer being in contact with the front end surface of the gap-depth defining layer; and

an upper magnetic pole layer connected to the back gap layer through the top surfaces of the gap layer and the gap-depth defining layer.

2. The magnetic head according to Claim 1, wherein the front end surfaces of the gap-depth defining layer and the first seed layer are continuous.

3. The magnetic head according to Claim 1, wherein the front end surface of the gap-depth defining layer is perpendicular to the top surface of the protruding layer.

4. The magnetic head according to Claim 1, wherein the total thickness of the gap-depth defining layer and the first seed layer is 0.5 μm or less.

5. The magnetic head according to Claim 1, wherein the nonmagnetic material for the gap-depth defining layer is selected from the group consisting of SiO_2, SiN, Ta_2O_5, Si_3N_4, and a resist.

6. The magnetic head according to Claim 1, wherein the top surfaces of the protruding layer, the coil-insulating layer, and the back gap layer are flat and continuous.

7. The magnetic head according to Claim 1, further

comprising another lower magnetic pole layer and another gap layer on the coil-insulating layer on the rear side of the gap-depth defining layer.

8. The magnetic head according to Claim 1, wherein

the lower magnetic pole layer, the gap layer, and the upper magnetic pole layer have the same planar shape; and

the width of the upper magnetic pole layer at the front surface of the magnetic head determines a track width.

9. The magnetic head according to Claim 1, wherein the rear end surface of the gap-depth defining layer is positioned on the protruding layer, the coil-insulating layer, or the back gap layer.

10. The magnetic head according to Claim 1, wherein the lower magnetic pole layer, the gap layer, and the upper magnetic pole layer are formed by plating.

11. The magnetic head according to Claim 1, further comprising an upper core layer on the upper magnetic pole layer, wherein

the upper core layer has the same planar shape as the upper magnetic pole layer; and

the upper and lower magnetic pole layers have a higher saturation magnetic flux density than the upper core layer.

12. The magnetic head according to Claim 1, wherein the

upper and lower magnetic pole layers have a higher saturation magnetic flux density than the lower core layer, the protruding layer, and the back gap layer.

13. The magnetic head according to Claim 1, wherein the planar shape of the upper magnetic pole layer comprises:

a front portion having a width that corresponds to a track width at the front surface of the magnetic head and that remains constant or increases in the height direction; and

a rear portion having a width that increases from the side base ends at the rear of the front portion in the height direction.

14. The magnetic head according to Claim 1, further comprising a second seed layer composed of a magnetic material, the lower magnetic pole layer being formed on the protruding layer with the second seed layer disposed therebetween.

15. The magnetic head according to Claim 14, further comprising a third seed layer extending from the rear end surface of the gap-depth defining layer onto the back gap layer, wherein

the second and third seed layers are separately formed;

the gap-depth defining layer is disposed between the second and third seed layers; and

another lower magnetic pole layer and another gap layer

are formed on the third seed layer.

16. The magnetic head according to Claim 15, wherein the third seed layer is composed of a nonmagnetic metal.

17. The magnetic head according to Claim 1, wherein the coil layer surrounds the back gap layer on a plane parallel to the top surface of the lower core layer.

18. The magnetic head according to Claim 1, wherein the coil layer helically surrounds the upper magnetic pole layer or the lower core layer.

19. A method for manufacturing a magnetic head, comprising the steps of:

(a) forming a lower core layer extending from the front surface of the magnetic head in the height direction of the magnetic head, the front surface of the magnetic head facing a recording medium;

(b) forming a coil-insulating seed layer on the lower core layer; and a coil layer at predetermined areas on the coil-insulating seed layer;

(c) forming a protruding layer and a back gap layer on the lower core layer before or after step (b), the protruding layer extending from the front surface of the magnetic head to a position not in contact with the front end surface of the coil layer in the height direction; and the back gap layer being separated from the rear end surface of the

protruding layer in the height direction such that the back gap layer is not in contact with the coil layer;

(d) covering the coil layer with a coil-insulating layer;

(e) forming a nonmagnetic material layer and a first seed layer on the protruding layer, the coil-insulating layer, and the back gap layer;

(f) patterning the first seed layer into a predetermined shape such that the first seed layer is separated from the front surface of the magnetic head by a predetermined distance;

(g) removing a portion of the nonmagnetic material layer uncovered by the patterned first seed layer to form a gap-depth defining layer; and

(h) forming a lower magnetic pole layer on the protruding layer on the front side of the gap-depth defining layer such that the rear end surface of the lower magnetic pole layer is in contact with the front end surface of the gap-depth defining layer; a gap layer on the lower magnetic pole layer such that the rear end surface of the gap layer is in contact with the front end surface of the gap-depth defining layer; and an upper magnetic pole layer connected to the back gap layer through the top surfaces of the gap layer and the gap-depth defining layer.

20. The method for manufacturing a magnetic head according to Claim 19, wherein, at step (g), the gap-depth defining layer and the first seed layer are formed such that

the front end surfaces thereof are continuous.

21. The method for manufacturing a magnetic head according to Claim 19, wherein, at step (g), the gap-depth defining layer is formed such that the front end surface thereof is perpendicular to the top surface of the protruding layer.

22. The method for manufacturing a magnetic head according to Claim 19, wherein,

at step (e), the nonmagnetic material layer is formed with a material selected from the group consisting of SiO_2, SiN, Ta_2O_5, Si_3N_4, and a resist; and,

at step (g), the uncovered portion of the nonmagnetic material layer is removed by reactive ion etching.

23. The method for manufacturing a magnetic head according to Claim 19, wherein, at step (e), the nonmagnetic material layer and the first seed layer are formed such that the total thickness thereof is 0.5 μm or less.

24. The method for manufacturing a magnetic head according to Claim 19, wherein, at step (d), the top surfaces of the protruding layer, the coil-insulating layer, and the back gap layer are processed into a continuous, flat surface after the coil layer is covered with the coil-insulating layer.

25. The method for manufacturing a magnetic head according to Claim 19, wherein, at step (h), the lower magnetic pole layer, the gap layer, and the upper magnetic pole layer are continuously formed by plating.

26. The method for manufacturing a magnetic head according to Claim 19, further comprising a step of continuously forming an upper core layer on the upper magnetic pole layer by plating after step (h), wherein, at step (h), the upper and lower magnetic pole layers are formed with a material having a higher saturation magnetic flux density than the upper core layer.

27. The method for manufacturing a magnetic head according to Claim 19, wherein, at step (h), the upper and lower magnetic pole layers are formed with a material having a higher saturation magnetic flux density than the lower core layer, the protruding layer, and the back gap layer.

28. The method for manufacturing a magnetic head according to Claim 19, wherein, at step (h),

the upper magnetic pole layer is formed in a planar shape comprising a front portion having a width that corresponds to a track width at the front surface of the magnetic head and that remains constant or increases in the height direction; and a rear portion having a width that increases from the side base ends at the rear of the front portion in the height direction; and

the lower magnetic pole layer, the gap layer, and the upper core layer are formed in the same planar shape as the upper magnetic pole layer.

29. The method for manufacturing a magnetic head according to Claim 19, wherein, at step (f), the first seed layer is patterned such that the rear end surface thereof is positioned above any one of the top surfaces of the protruding layer, the coil-insulating layer, and the back gap layer.

30. The method for manufacturing a magnetic head according to Claim 19, further comprising a step of forming a second seed layer of a magnetic material on the protruding layer between steps (d) and (e).

31. The method for manufacturing a magnetic head according to Claim 19, further comprising between steps (d) and (e) a step of forming a third seed layer such that the third seed layer is disposed between the rear end surface of the gap-depth defining layer and the front end surface of the back gap layer, wherein,

at step (f), the first seed layer is patterned to remain above the area between the protruding layer and the third seed layer; and,

at step (h), another lower magnetic pole layer and another gap layer are formed on the third seed layer by plating.

32. The method for manufacturing a magnetic head according to Claim 31, wherein the third seed layer is formed with a nonmagnetic metal.

33. The method for manufacturing a magnetic head according to Claim 19, wherein the coil layer is formed so as to surround the back gap layer on a plane parallel to the top surface of the lower core layer.

34. The method for manufacturing a magnetic head according to Claim 19, wherein the coil layer is formed in a helical shape comprising:

first coil segments in a space surrounded by the lower core layer, the protruding layer, and the back gap layer, the first coil segments extending in a direction crossing the height direction; and

second coil segments on the upper magnetic pole layer with an insulating layer disposed therebetween, the second coil segments extending in a direction crossing the height direction, wherein

ends of the first coil segments opposed to ends of the second coil segments in the thickness direction of the upper magnetic pole layer are connected to the ends of the second coil segments.